REMARKS

Statement of Substance of Interview

As an initial matter, counsel would like to thank the Examiners, Messrs. Kim and Landau for the courtesies extended during the personal interview conducted March 5, 2008.

The Interview Summary dated March 5, 2008 provides an accurate summary and statement of the substance of the interview with the Examiners.

Response to Office Action Mailed November 21, 2007

In the present Amendment, claims 1 and 6 have been amended to recite that a group III nitride semiconductor multilayer film is formed above the mask. Section 112 support for this amendment may be found, for example, in the Examples. No new matter has been added, and entry of the Amendment is respectfully requested.

Claims 1-4, 6-9 and 11 are pending.

In paragraph No. 3 of the Action, claims 1-4, 6-9 and 11 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Tadatomo et al (U.S. 6,225,650) in view of Motoki et al (U.S. 2003/0145783).

Applicants submit that this rejection should be withdrawn because Tadatomo et al and Motoki et al do not disclose or render obvious the present invention, either alone or in combination.

In the Office Action, the Examiner reasons that "it would have been obvious that a nitride semiconductor substrate comprising a low dislocation density is used for improving device characteristics, and a multilayer mask structure including a polycrystalline material for GaN

crystal growth is well-known and the polycrystalline material would cause different GaN growth kinetics than a single mask structure and thus allow for better control of GaN growth."

Applicants respectfully disagree.

Motoki et al do not disclose that the GaN growth characteristics are changed depending on the kinds of the multilayer mask structure including a polycrystalline material. Specifically, Motoki et al illustrate in Embodiment 3 (Differences of Mask Materials) (paragraphs [0391] to [0430]) GaN growth characteristics in cases where different kinds of mask materials are used. The mask materials of Samples A and J to N are shown below, wherein the Si_3N_4 film (J) is amorphous, the Pt film (K) is polycrystalline, the W film (L) is polycrystalline, sole SiO_2 film (A) is amorphous, and the SiO_2 films on GaN or AlN are fine polycrystalline (M and N) (see paragraph [0401]).

Sample No.	Materials of mask film
Sample A (Embodiment 1)	SiO_2 (amorphous)
Sample J	Si_3N_4 (amorphous)
Sample K	Pt (polycrystalline)
Sample L	W (polycrystalline)
Sample M	GaN/SiO_2 (polycrystalline)
Sample N	AlN/SiO_2 (polycrystalline)

In paragraph [0410], it is disclosed that "[I]n Samples J, L, M and N, shallower facets appear at bottoms 59 between the neighboring {11-22}. ... Appearance of the Samples is the same one as Sample A of Embodiment 1."

In paragraph [0417], it is disclosed that "Samples J, L, M and N are similar to Sample A of Embodiment 1 in the state of the voluminous defect accumulating regions (H)."

In paragraph [0419], it is disclosed that "[E]stimation based on the TEM and the CL observation clarifies that the voluminous defect accumulating regions (H) hanging from the valleys 59 held by the facet 56 are single crystals in Samples J, L, M and N."

In paragraph [0420], it is disclosed that "[I]n Samples M and N, the voluminous defect accumulating regions (H) are single crystal,...."

That is, Motoki et al disclose that Samples A, J, L, M and N are similar in their appearance, state of grown GaN, and GaN growth kinetics.

Although the dislocation densities of the Samples M and N are lower than that of the Sample J, the mask materials of these samples are different, and therefore, they are not comparable. That is, it is not clear from the disclosure of Motoki et al whether the presence of the polycrystalline material on the mask film has effects on the dislocation density.

Additionally, Applicants have advised that it was generally believed at the time the present invention was made, that polycrystalline materials on the mask may cause undesirable influences with respect to the states of the grown GaN.

Therefore, it would not have been obvious to those skilled in the art that a nitride semiconductor substrate comprising a low dislocation density, and multilayer mask structure including a polycrystalline material, may be employed to improve device characteristics.

Further, in Tadamoto et al, a GaN group crystal layer 3 is formed on a base substrate 1. The material of the base substrate 1 may be, for example, sapphire crystal, rock crystal, SiC and the like (col. 4, lines 12-14). Tadamoto et al does not teach or suggest that a Group III nitride semiconductor substrate is used for growth of the Group III nitride such as GaN crystal.

In Motoki et al, GaN crystals are grown on an undersubstrate 41, wherein the material of the undersubstrate is sapphire (Embodiment 1), GaAs (Embodiments 2 and 3), as well as O and P (Embodiment 4). Motoki et al does not teach or suggest that a Group III nitride crystal is grown on a Group III nitride substrate.

Generally, in the event that a nitride crystal (e.g., GaN, AlN, AlGaN) is grown on a substrate which is other than nitride (e.g., sapphire, SiC, GaAs), increased dislocations are generated from the interface between the grown nitride crystal and the substrate due to the difference in their own lattice constants, thermal expansion coefficients and polar characters.

In Motoki et al, the problem of increased dislocations is addressed by forming defect accumulating regions and low dislocation single crystal regions. Furthermore, as discussed above, it is not clear from the disclosure of Motoki et al whether the presence of the polycrystalline material on the mask film has effects on the dislocation density.

The presently claimed nitride semiconductor substrate is based on the premise that a Group III nitride semiconductor substrate having a dislocation density in the vicinity of the

surface thereof of 1 x 10^7/cm^2 or less is used, and a group III nitride semiconductor multilayer film is formed above the group III nitride semiconductor substrate. In case that such a substrate is used and a group III nitride semiconductor is grown thereon, Applicants have found that the following problems are caused, based on their investigation as described at page 4, line 13 to page 6, line 13 of the present specification:

When a mask is provided on a low dislocation substrate and a Group III nitride semiconductor is grown thereon, many dislocations develop from the vicinity of the mask (page 6, lines 21-23 of the specification), and the development of this type of dislocation is marked when a substrate having a low dislocation density is used (page 6, lines 24-25).

These phenomena become more apparent for a substrate in which dislocations have been reduced to less than 10^7/cm^2 (page 6, lines 26-27 of the specification).

That is, in case that a Group III nitride semiconductor is grown on a substrate having a low dislocation density, many dislocations develop from the vicinity of the mask.

According to the presently claimed invention, the above problems are solved by using a polycrystalline material deposited on the surface of the mask.

Since the inventions of Motoki et al and Tadamoto et al are different from the present invention in premise, the present invention would not have been obvious over Motoki et al and Tadamoto et al.

Still further, the significant effects of the present invention are shown in Examples 1-6 of the present specification. As can be seen in the Examples 1-6, the dislocations in the <11-20>

direction are decreased, and dislocations present in the layer structure above the mask are reduced.

In view of the above, reconsideration and withdrawal of the § 103(a) rejection based on Tadatomo et al in view of Motoki et al are respectfully requested.

Allowance is respectfully requested. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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